

Conceptual Site Model Discussion to Facilitate Completion of the RI/SCE

Northwest Pipe Company

Presented by CH2M

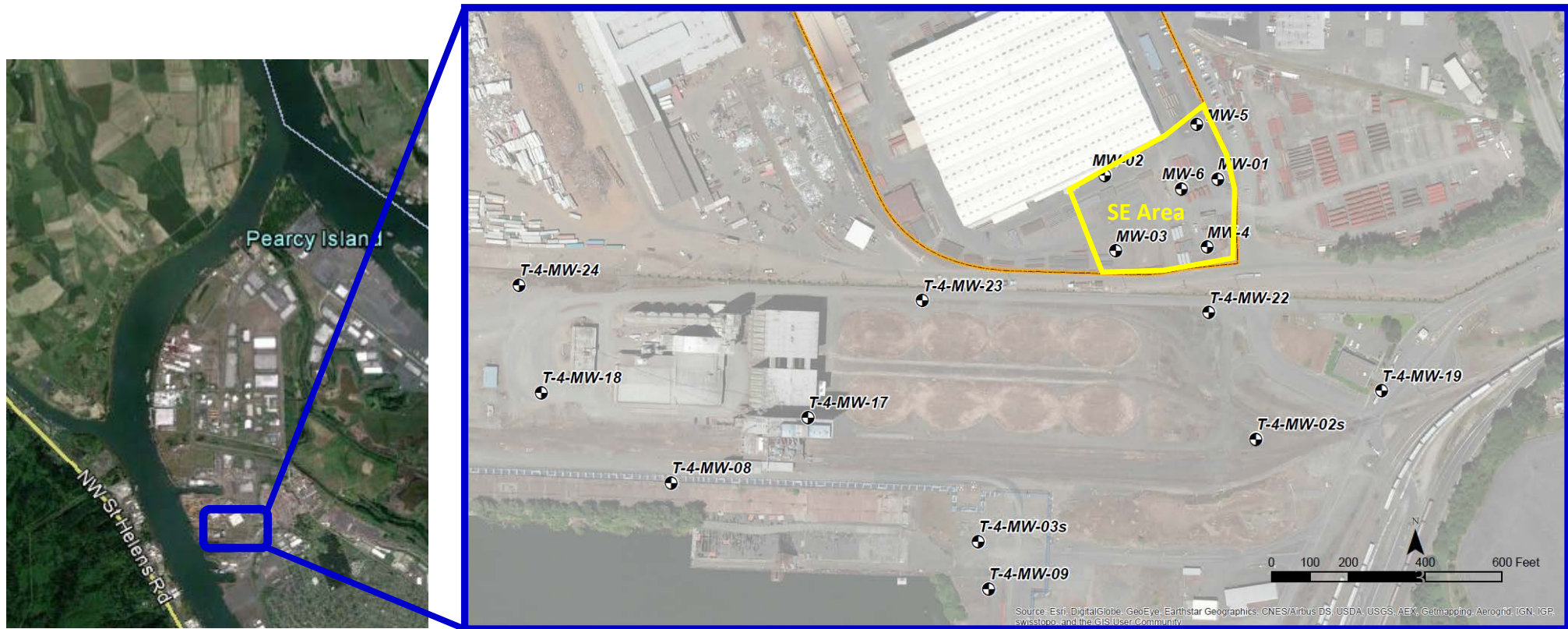
November 10, 2015

Agenda

- Introduction
- Hydrogeologic setting
- Presence of VOCs in SE Area
- Comparison of the Northwest Pipe CSM and Agency concerns
- Discussion

Introduction

- Northwest Pipe Company has worked interactively with DEQ project managers on the source control evaluation since 2000
- VOCs were identified in a discrete part of southeast (SE) area of the site using initial direct-push groundwater samples



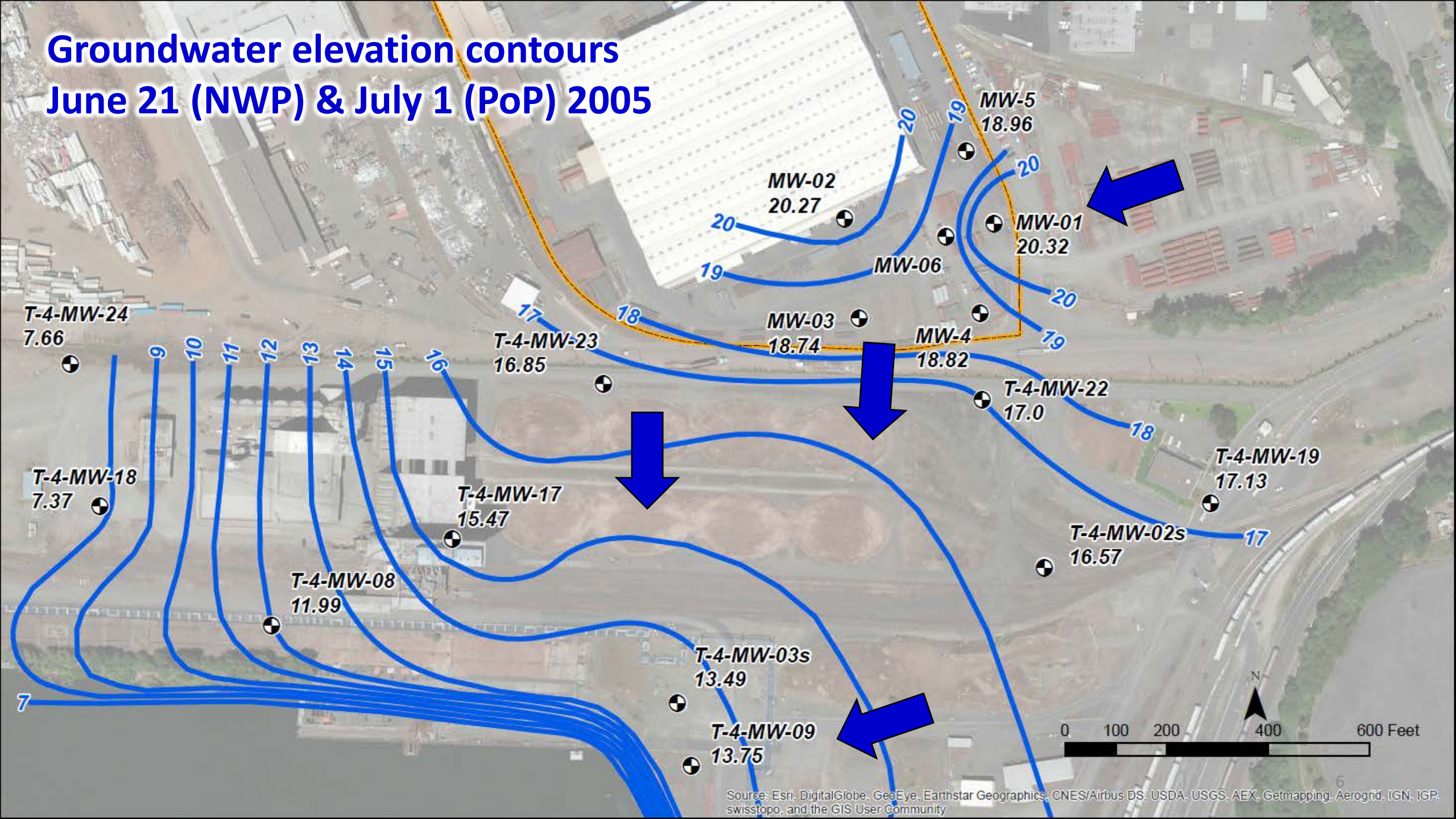
Introduction (cont'd)

- Expanded work followed, including additional direct-push samples and monitoring well installation and sampling
- No additional groundwater sampling work in the SE area was requested by DEQ during 2008 work planning for completing the RI/SCE nor in DEQ comments to previous drafts of the report
- DEQ has long been in agreement that the groundwater pathway for VOCs is incomplete and not significant. For the RI/SCE, Northwest Pipe was asked to expand the groundwater risk assessment and describe the lines of evidence for why the observed concentrations should be acceptable for source control.
- As recently as late November 2014, the DEQ Summary Report for Portland Harbor stated that *“VOC concentrations in groundwater at the site are not significant or connected to the river.”*
- The request for additional samples very late in the process was therefore unexpected and contraindicated by the data

Focused hydrogeology summary

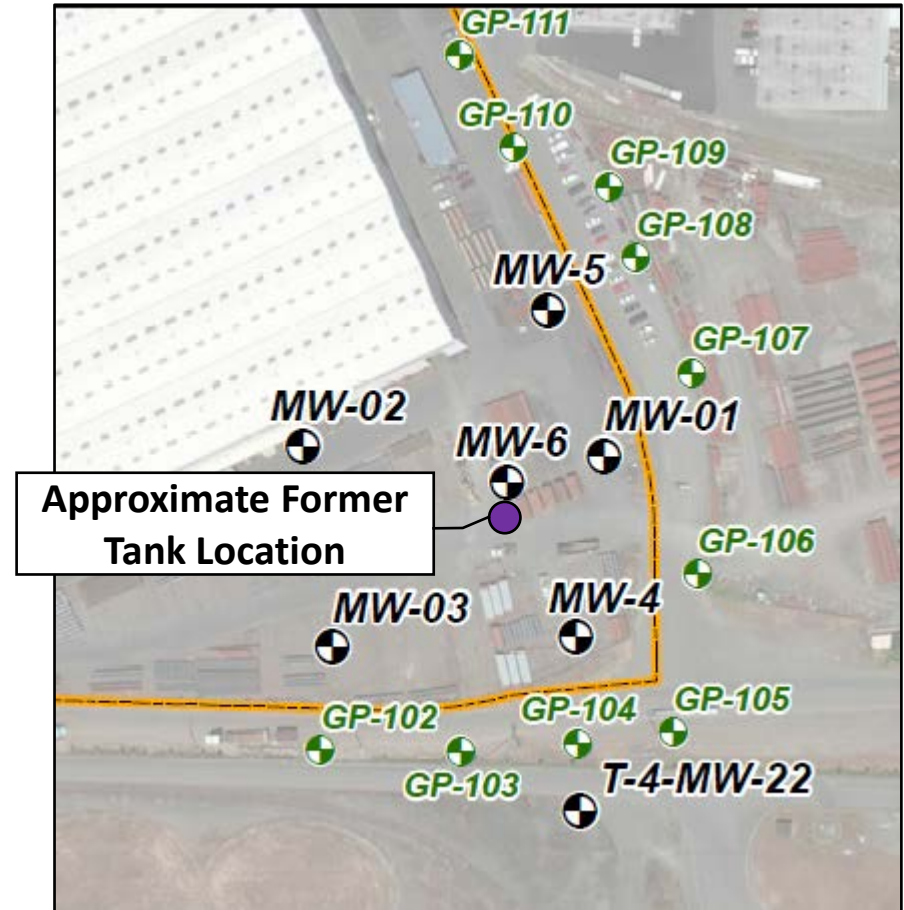
- The Northwest Pipe site, as well as the surrounding areas, reside on made ground created by placing about 28 feet of Willamette River dredged material on the mud flats that previously were located in this area.
- The lower part of the fill material became saturated over time, with the former ground surface (mud flats) forming a confining layer that constitutes the base of the shallow water bearing zone – depth to groundwater is about 10 to 14 feet bgs, depending on location.
- Because of the natural organic matter in the fill material, this shallow groundwater exists under geochemically reducing conditions, with the naturally-elevated iron and manganese concentrations consistent with reducing conditions.
- Groundwater flow in the SE area is to the SSW, becoming more westerly on the Port of Portland T4 site near the slip, with a velocity of about 8 feet per year.

Groundwater elevation contours June 21 (NWP) & July 1 (PoP) 2005



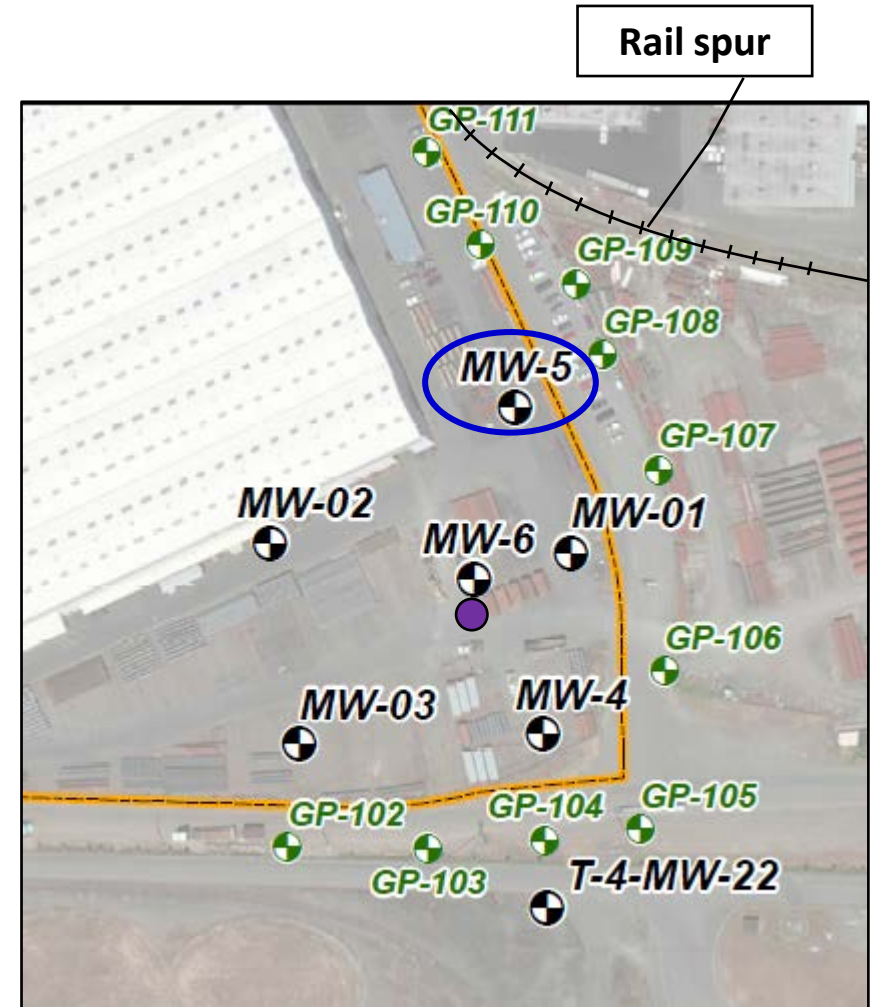
Northwest Pipe CSM

- One suspected source of VOCs was a waste oil tank and associated stained soil that was removed in late 1980s in the vicinity of MW-6
- The initial concentrations observed in an offsite direct-push sample, located upgradient and to the east of the site, were higher than in monitoring well MW-5 located onsite.
- MW-5 concentrations increased over time, evidencing an offsite plume migrating onto the site.



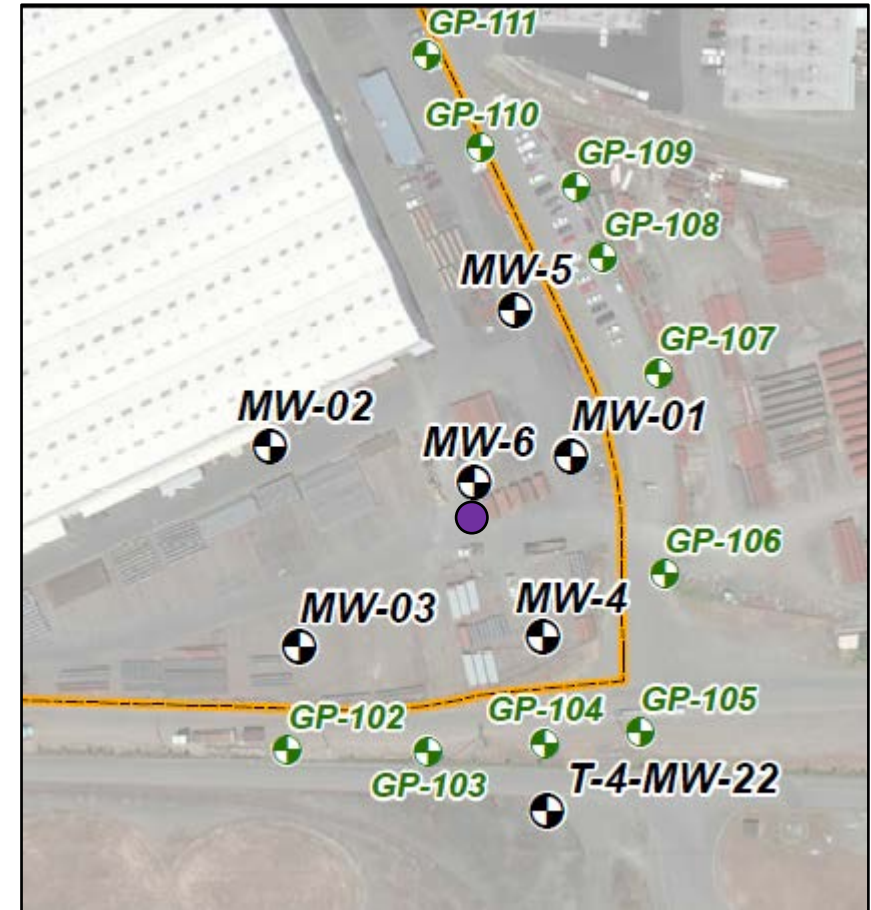
Northwest Pipe CSM

- The second source of VOCs in groundwater may have been related to rail car spills, including tank cars, parked on the railroad track spur east of Northwest Pipe that served the Burgard Industrial Park or one of the metalworking industries located east or northeast of the Northwest Pipe site.
- The precise location of the upgradient source has not been identified, but the changes in concentration and types of VOCs present indicate an upgradient source.

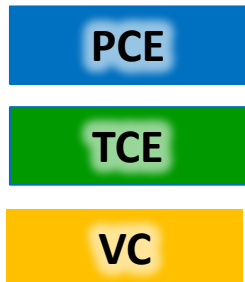
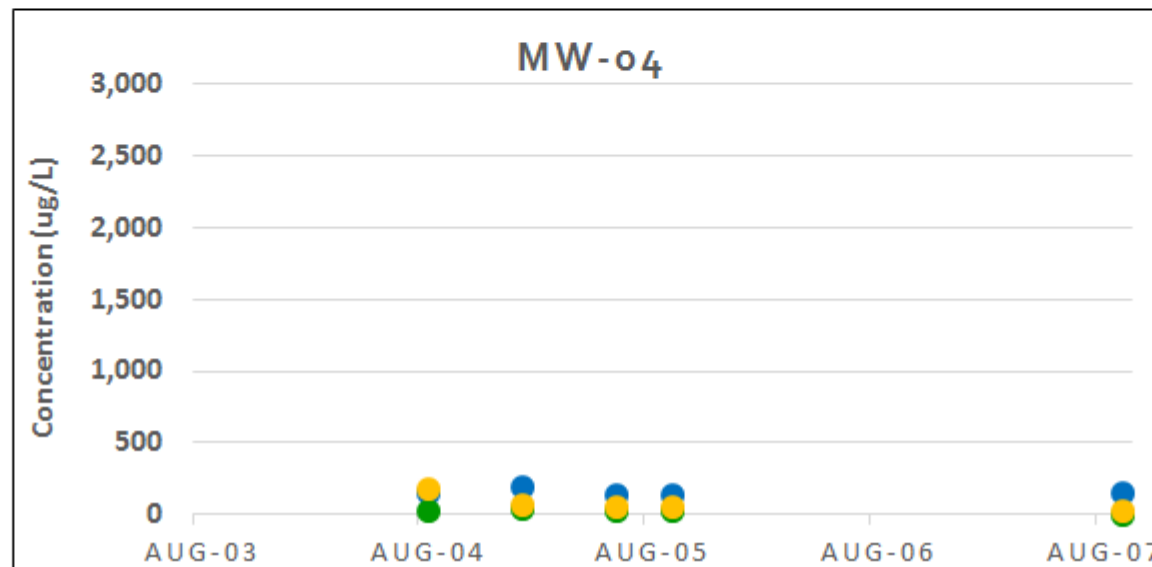
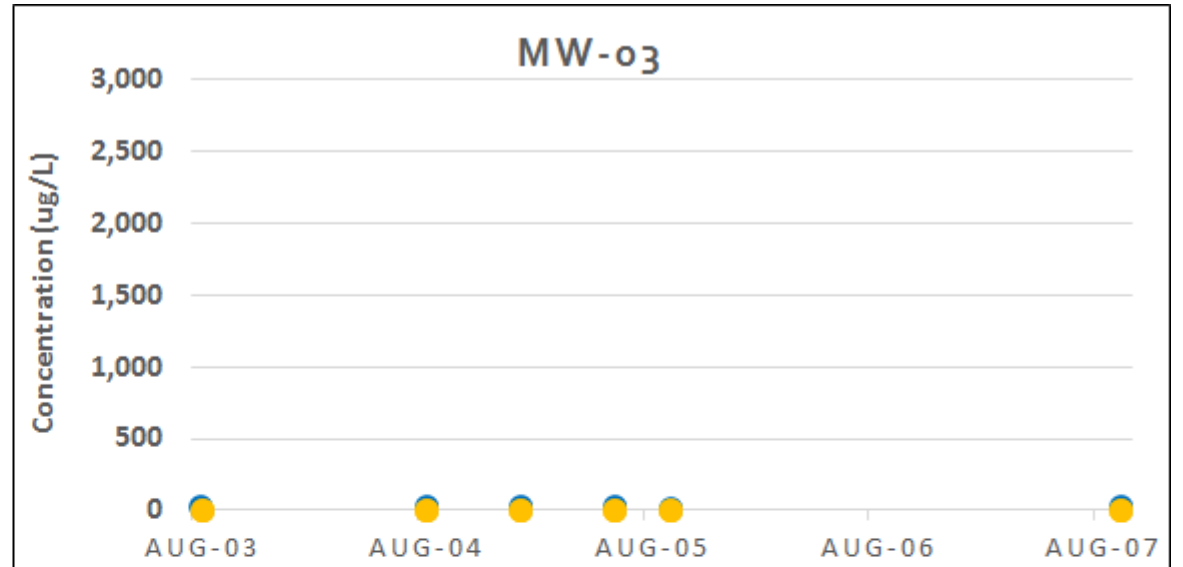
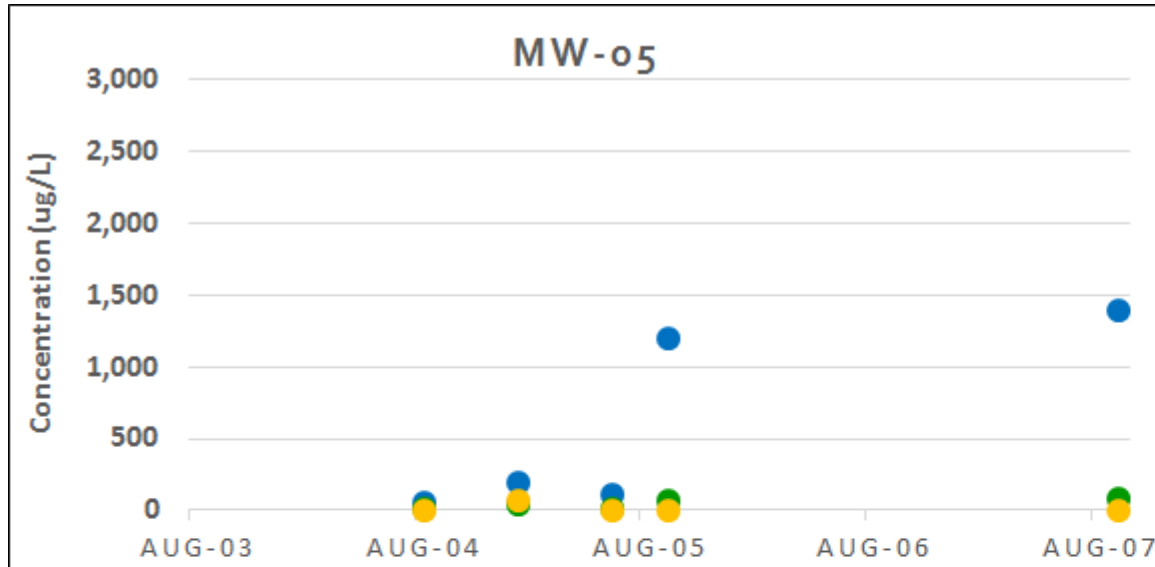


Northwest Pipe CSM

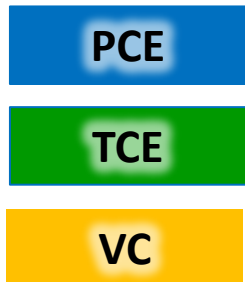
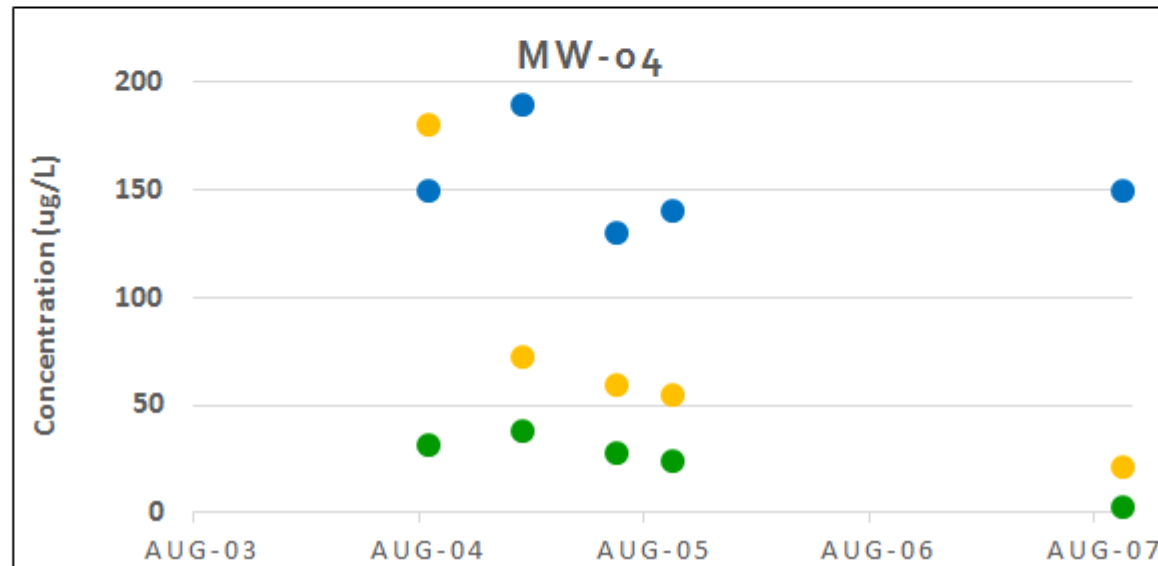
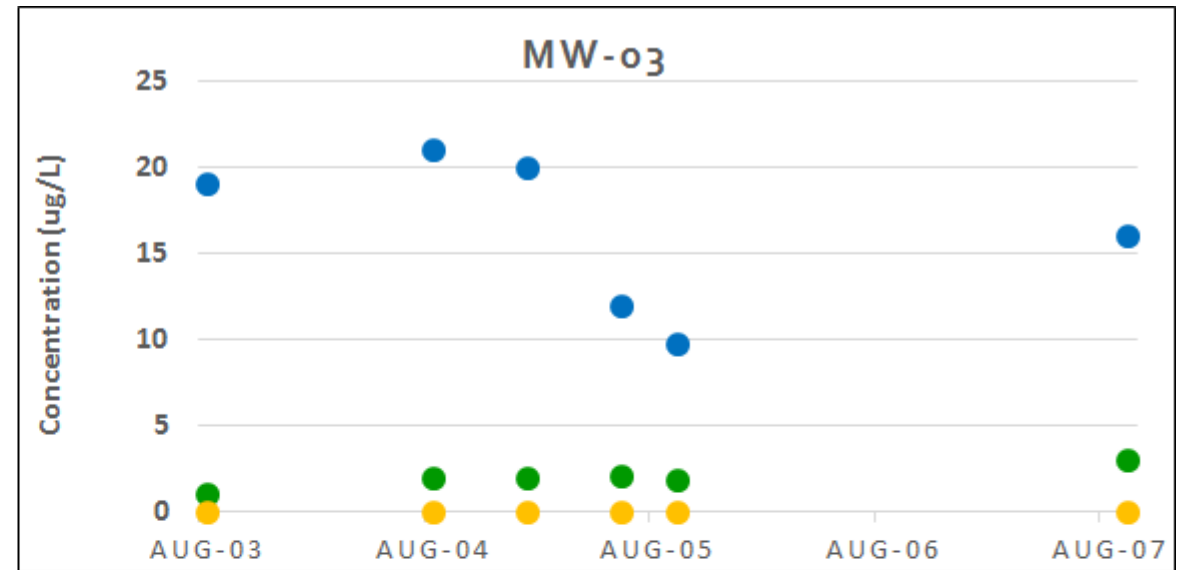
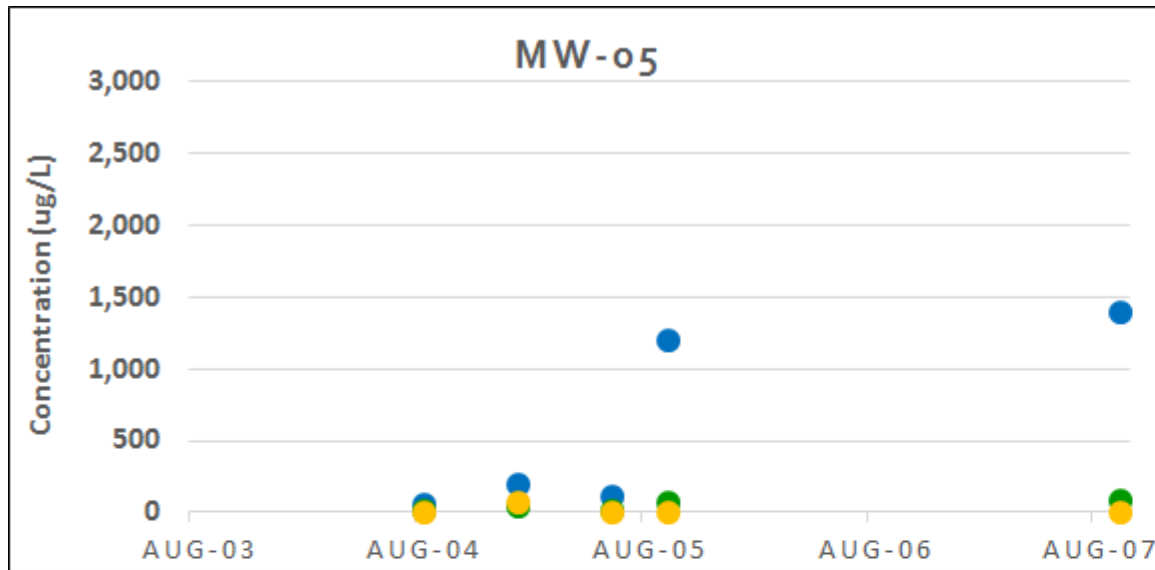
- Meanwhile, concentrations further downgradient have fluctuated but are lower in the most recent samples than they were in the initial samples, consistent with the a source that had been removed.
- Using EPA guidance, the site was found to have very favorable conditions for natural reductive dechlorination of VOCs.
 - NWP scored in category of “strong evidence” for chlorinated solvent degradation according to EPA screening worksheet using site geochemical data
 - Presence of daughter products: trans-1,2-DCE, cis-1,2-DCE, 1,1-DCE, and vinyl chloride
- Biochlor modeling and sensitivity analysis predicted VOC concentrations would drop below then-levels of potential concern prior to reaching any surface water.



VOC concentrations on NWP property – same scale

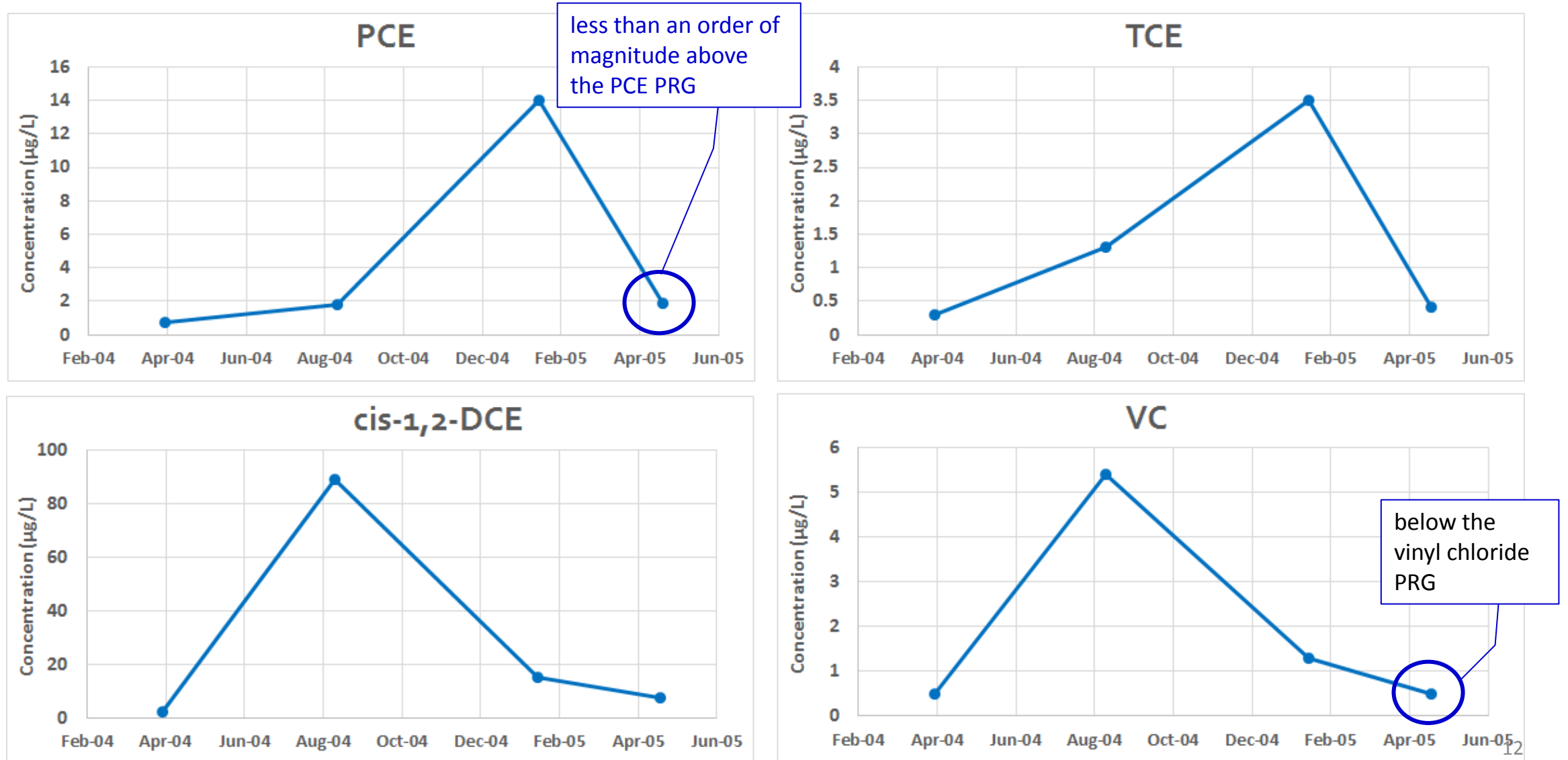


VOC concentrations on NWP property – expanded scale



T₄-MWO₃s VOC concentrations

Variable proportions of parent and degradation products over time suggest a nearby source



Additional observations about VOCs

- Relative proportion, or mole fraction, of PCE to daughter product CVOCs can be used to evaluate characteristics of CVOC source
- The mole fraction of parent compound (PCE) increased between 2004 and 2007, indicating a plume from a relatively non-degraded source was migrating onto the site – this would indicate a geographically nearby upgradient source, such as the rail spur.

Mole fraction (as percent) PCE in MW-5

Aug 2004	Jan 2015	Jun 2015	Sep 2015	Sep 2007
16%	66%	49%	77%	68%

- At Port well MW-03s, PCE mole fraction in the typical samples (April & August 2004 and May 2005) ranged from 1% to 12% whereas the outlier sample (January 2005) had 29% PCE. It is possible the outlier sample EPA focused on in its comments reflected a nearby source to Port well MW-03s, which is located about 1,000 feet from the Northwest Pipe property.

Agency comments on the Northwest Pipe CSM

- EPA commented that the Northwest Pipe CSM is “*not supported*” by site data, pointing to:

“...lower concentrations of PCE detected in groundwater at the boring between monitoring well MW-5 and the rail spur (i.e., geoprobes GW 11, GP-108, GP-109, GP-110, and GP-111).”

- In its 22 July 2015 email, DEQ stated:

“DEQ respectfully disagrees that there is significant evidence of an offsite source of VOCs offsite and up gradient of the NWP site to the east or northeast.”

Agency CSM summarized

- Sole source of VOCs in groundwater upgradient of, at, and downgradient of the SE area of the Northwest Pipe site is located on the Northwest Pipe site itself
- Groundwater flow is toward PoP Terminal 4 Slip 1
- Distribution and concentrations of CVOCs and the underlying geochemical conditions at the site are consistent with reductive dechlorination as an important fate process for chlorinated solvents
- Concentrations of VOCs are discharging to the Willamette River at concentrations that may pose a risk to potential receptors

Key differences between CSMs

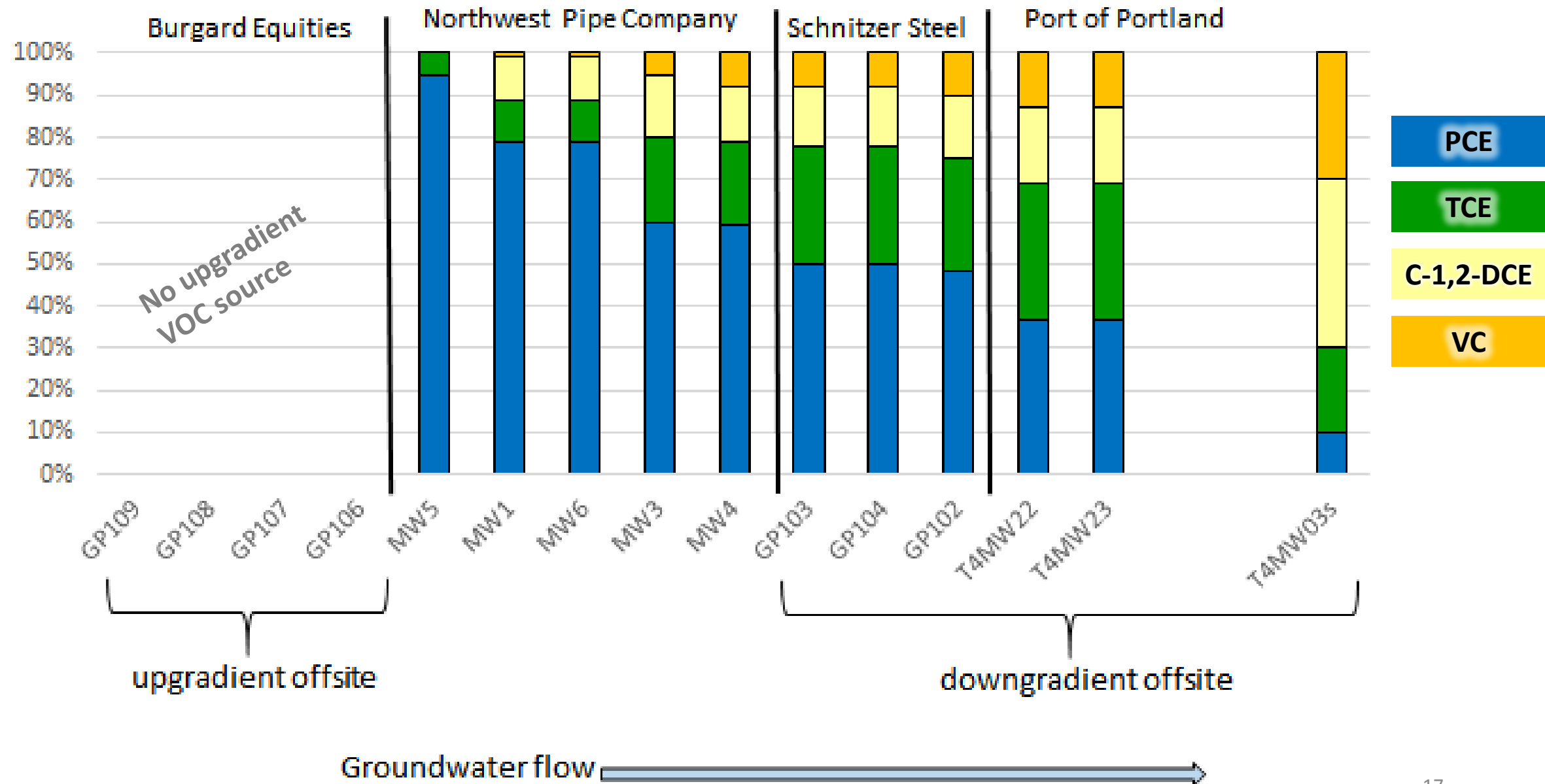
NWP

- Offsite sources indicated
 - Upgradient source impacting NWP property
 - Downgradient sources contributing to CVOCs on Port property
- CVOC distribution uncharacteristic of single, aged source, but is consistent with more than one source
- CVOCs unlikely to discharge to Willamette River at concentrations posing risk to potential receptors

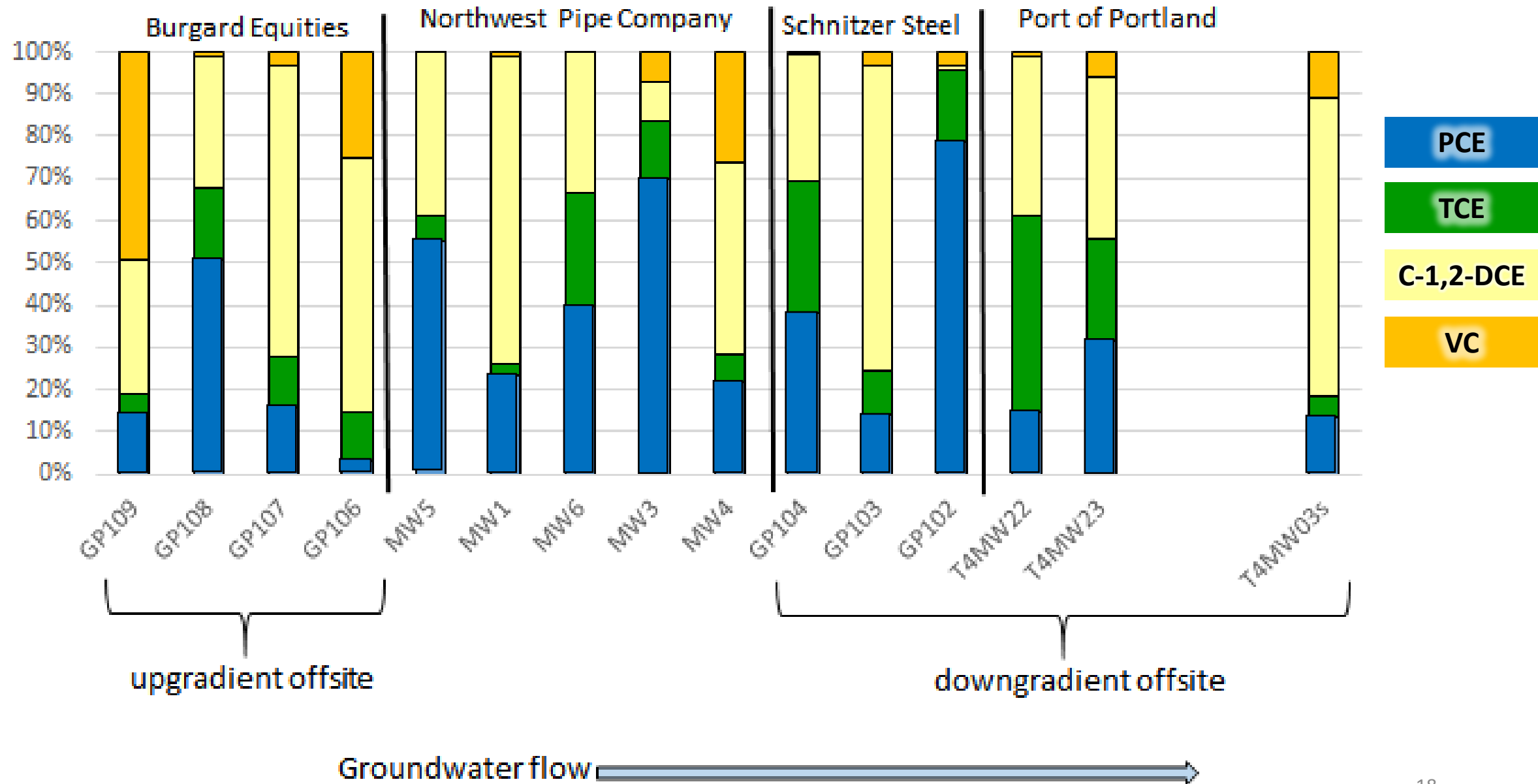
Agency

- NWP property sole source
- CVOC signature fits reductive dechlorination profile of a single, aged source.
- CVOCs are discharging to the Willamette River at concentrations that may pose a risk to potential receptors

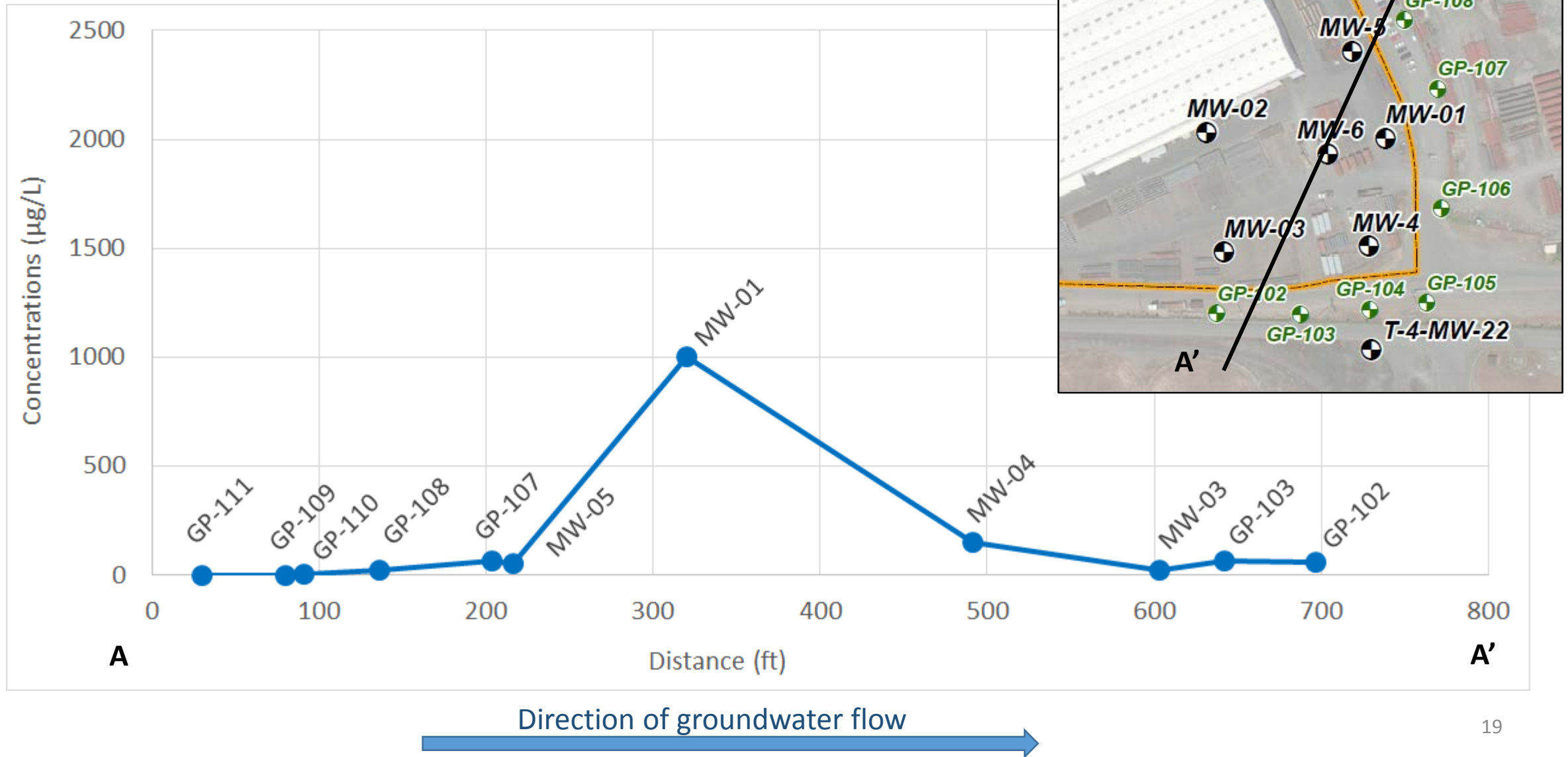
Mole fraction of chlorinated ethenes - Agency CSM



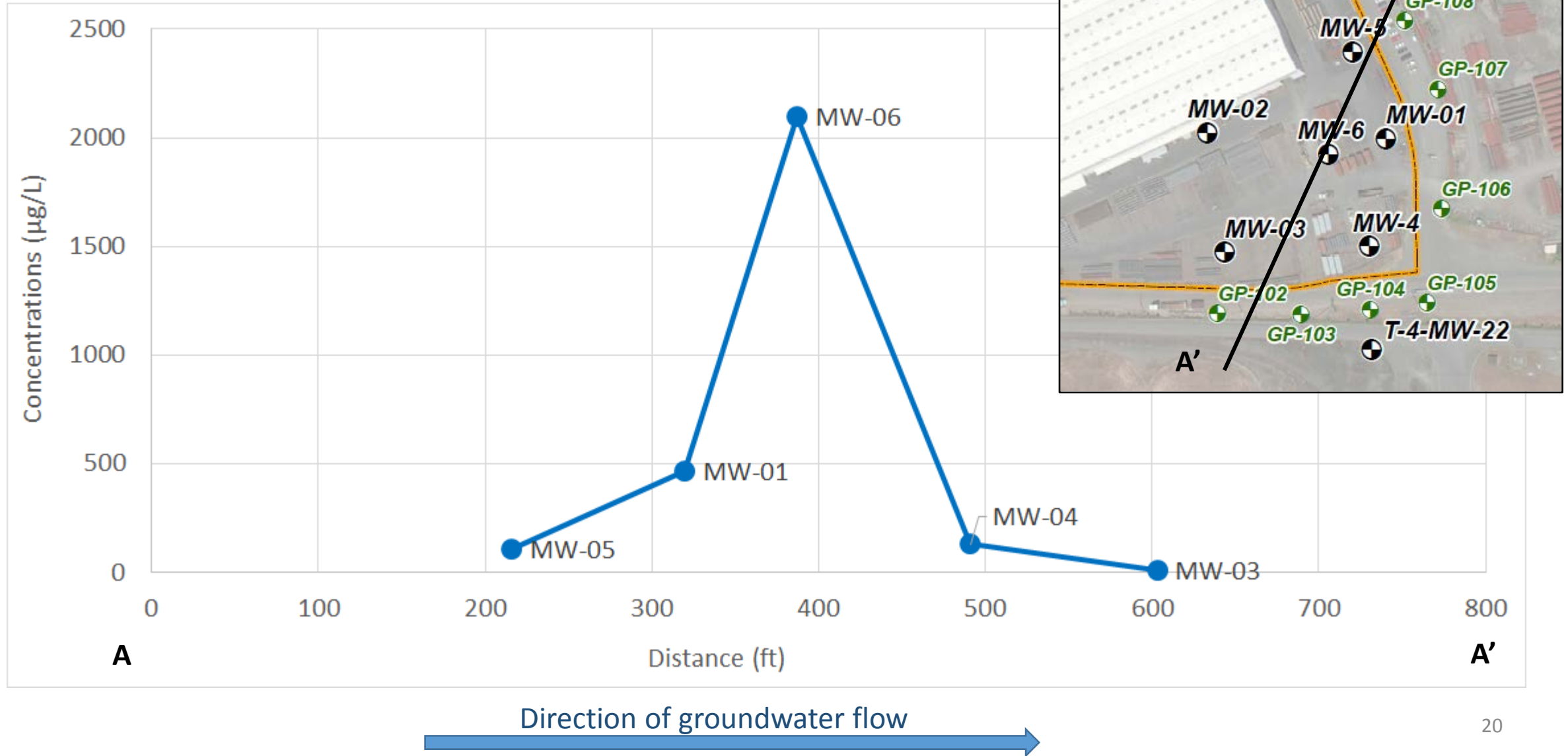
Mole fraction of chlorinated ethenes – Observed Data



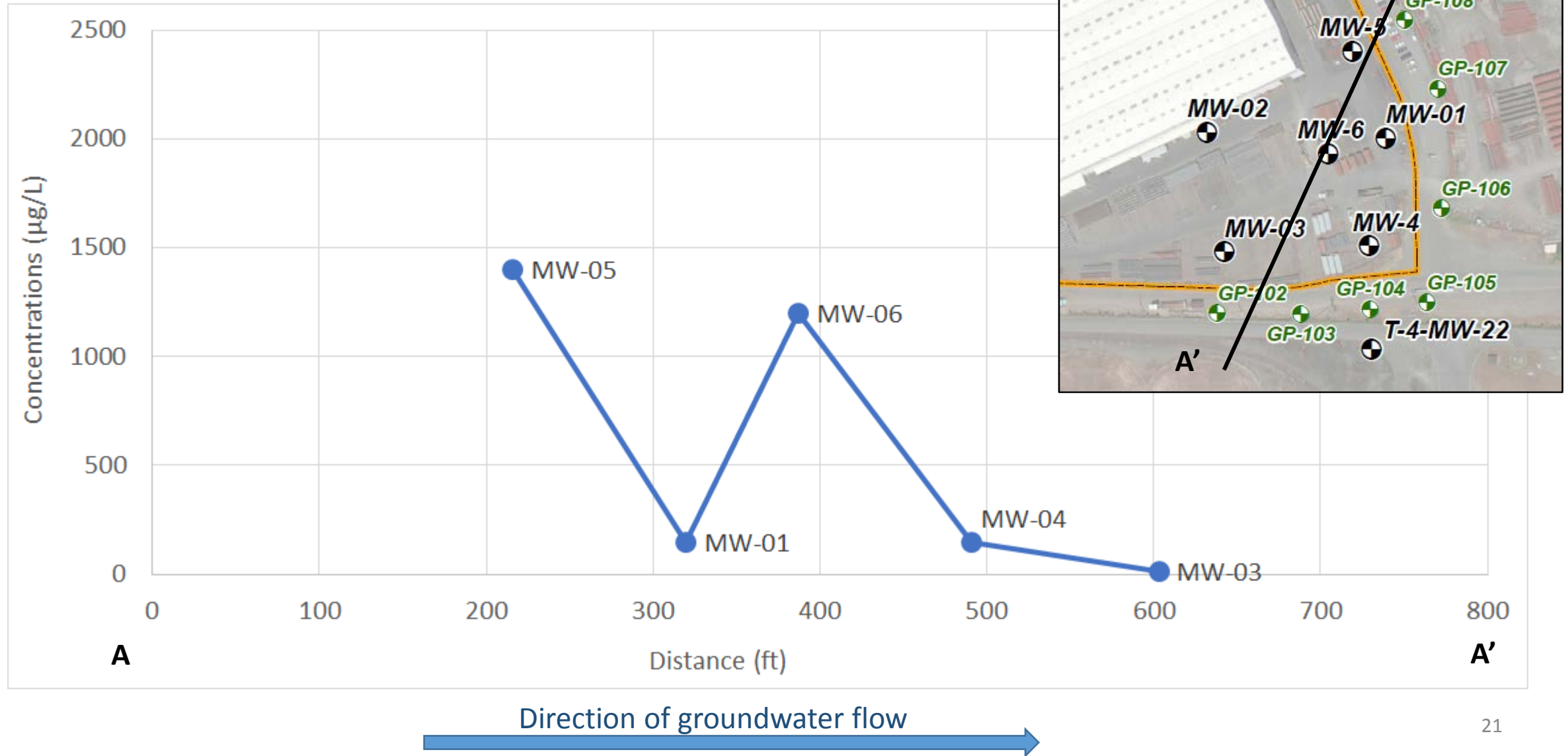
PCE concentrations (July/August 2004)



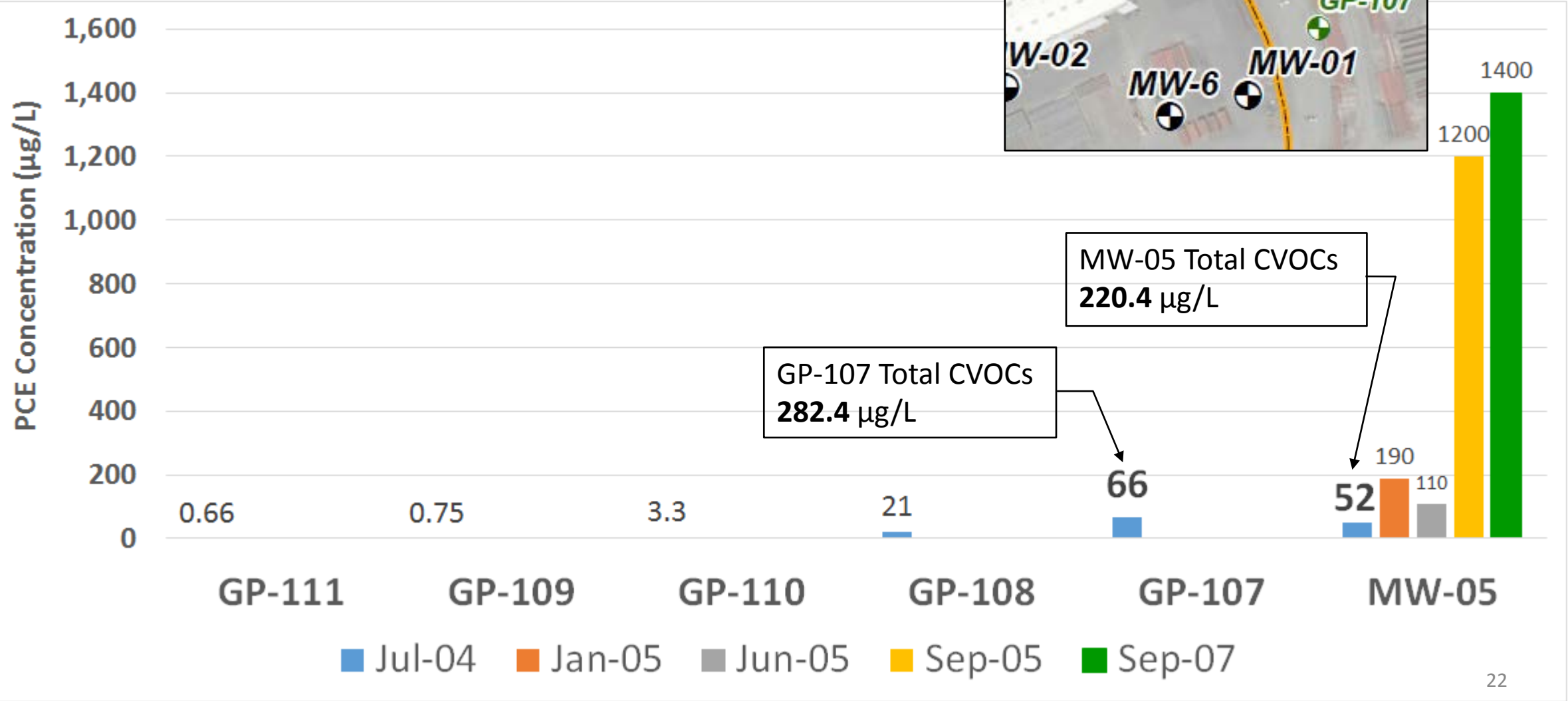
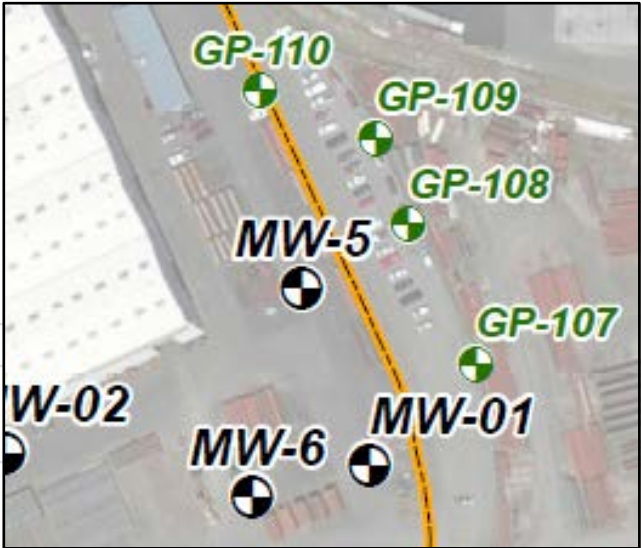
PCE concentrations (June 2005)



PCE concentrations (September 2007)



PCE concentration greater upgradient and offsite in GP-107 in contemporaneous samples:
Supporting the influence of offsite source



Summary

- The spatial distribution of VOCs on Northwest Pipe property is consistent with a source on the Northwest Pipe property and a source offsite to the east/northeast. The time-series concentration of VOCs in wells is consistent with a contribution from an upgradient offsite source.
- The relative proportion of degradation products, as an indication of plume “maturity,” is consistent with an old, degraded plume in the upgradient part of the SE area initially, being replaced by a plume made up predominately of PCE – a parent compound. This suggests a source coming from offsite.

Summary (cont'd)

- Although both the Northwest Pipe property and the Port property contain chlorinated ethenes in groundwater, these compounds were very commonly used in industrial applications (including as a grain fumigant and protectant -- *ATSDR Case Studies in Environmental Medicine, Tetrachloroethene Toxicity 2008*) and there is no direct evidence connecting the chlorinated ethenes detected on the Northwest Pipe site with the compounds detected in Port monitoring well MW-03s.
- The Port's well MW-03s shows variable proportions of parent and degradation products over time, which indicates a nearby source.
- The most recent concentrations in MW-03s are very low, less than an order of magnitude above the PCE PRG and below the vinyl chloride PRG.

Summary (cont'd)

- Given the combination of natural reductive dechlorination and dispersion in the aquifer, followed by mixing in the tidal hyporheic zone, and after discharge to the river, and considering the overlapping conservative assumptions inherent to screening groundwater concentrations against surface water criteria, these low concentrations should not preclude a positive source control decision.
- When considering all the site groundwater samples taken over the investigation period (2004-2007), concentrations of VOCs in Northwest Pipe site groundwater are decreasing over time, with the exception of the plume migrating onto the Northwest Pipe site from an upgradient source.
- For these reasons, additional sampling by Northwest Pipe is not warranted.

Discussion